Indian Society of Lifestyle Medicine

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Issue 5 **E-Newsletter** **August 2024**

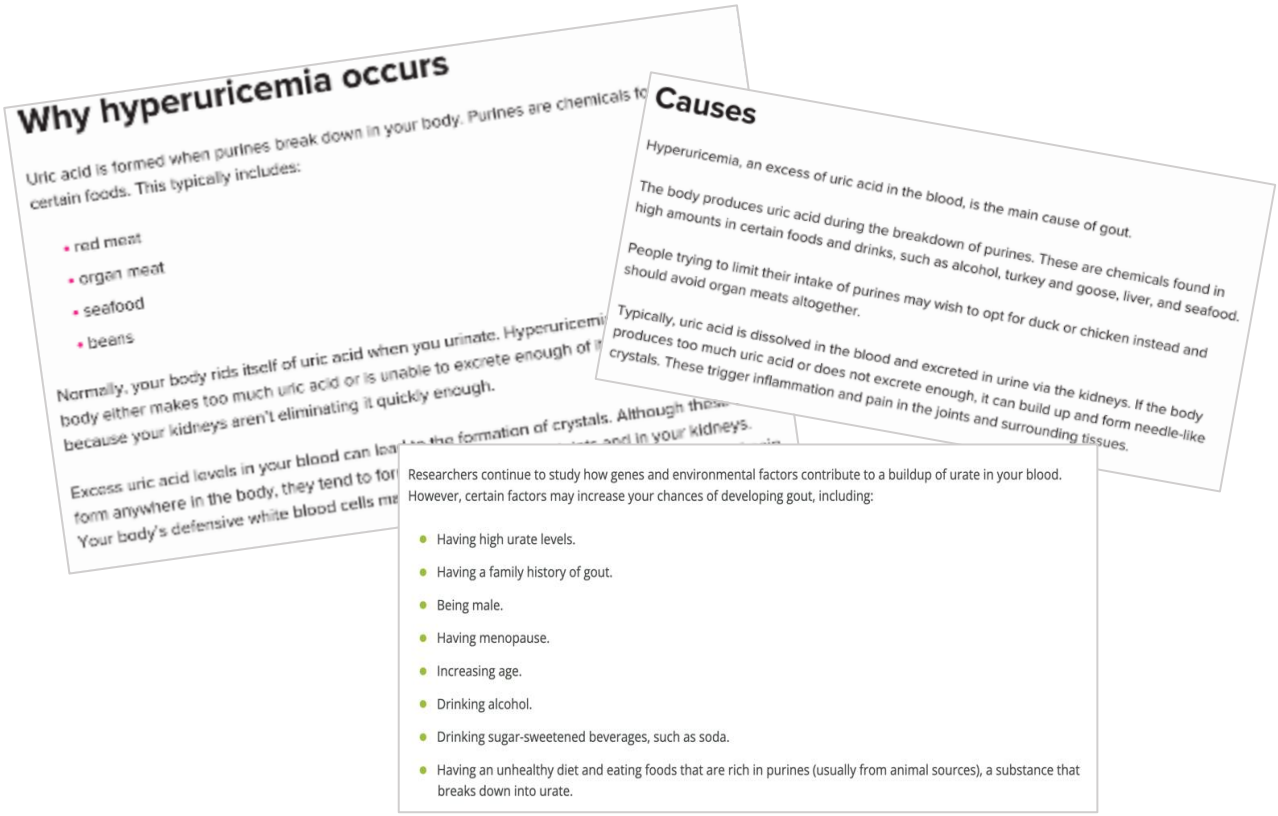
Content	Page no
Message from President ISLM Rabbanie Tariq	
From the Editor's desk Richa Lal	
About "Indian Society of Lifestyle Medicine" Lakshmi Sundar	
Invited Article: *Sugar's sour side: exploring it's role in hyperuricemia and gout* Nrutya Subramanyam	
Invited Article: *Making healthy choices stick: harnessing the psychology of habit formation* Shruthi Thennati	
Book Review *Why we sleep. Author: Mathew Walker* Bhavani V	
Recipe *Plant based dahi bhalle* Smriti Naswa	

Sugar's sour side:
Exploring it's role in hyperuricemia and gout

Dr. Nrutya Subramanyam

When we encounter patients with increased uric acid levels or gout, a common practice is to inquire about their consumption of meat and animal products. This is due to the well-known fact that purine-rich foods increase uric acid production, as uric acid is the end product of purine metabolism. Medical training has traditionally emphasized the link between purine-rich foods and elevated uric acid. During our training in medical school, we were taught only about association between foods rich in purines and uric acid.

Even in the present age if one does a Google search of Uric Acid and Gout, the foods most commonly listed are of animal origin and regarded as the primary culprits



Why hyperuricemia occurs

Uric acid is formed when purines break down in your body. Purines are chemicals fo
certain foods. This typically includes:

- red meat
- organ meat
- seafood
- beans

Normally, your body rids itself of uric acid when you urinate. Hyperuricemi
body either makes too much uric acid or is unable to excrete enough of
because your kidneys aren't eliminating it quickly enough.

Excess uric acid levels in your blood can lea the formation of crystals. Although the
form anywhere in the body, they tend to for and in your kidneys.
Your body's defensive white blood cells ma

Causes

Hyperuricemia, an excess of uric acid in the blood, is the main cause of gout.

The body produces uric acid during the breakdown of purines. These are chemicals found in high amounts in certain foods and drinks, such as alcohol, turkey and goose, liver, and seafood.

People trying to limit their intake of purines may wish to opt for duck or chicken instead and should avoid organ meats altogether.

Typically, uric acid is dissolved in the blood and excreted in urine via the kidneys. If the body produces too much uric acid or does not excrete enough, it can build up and form needle-like crystals. These trigger inflammation and pain in the joints and surrounding tissues.

Researchers continue to study how genes and environmental factors contribute to a buildup of urate in your blood. However, certain factors may increase your chances of developing gout, including:

- Having high urate levels.
- Having a family history of gout.
- Being male.
- Having menopause.
- Increasing age.
- Drinking alcohol.
- Drinking sugar-sweetened beverages, such as soda.
- Having an unhealthy diet and eating foods that are rich in purines (usually from animal sources), a substance that breaks down into urate.

Yet, in my practice, I observed that many of my patients with high uric acid levels or gout symptoms were either Ovo-Lacto vegetarians or Lacto-vegetarians. This quite baffled me and left me scratching my head as to what dietary advice, could I possibly give them?

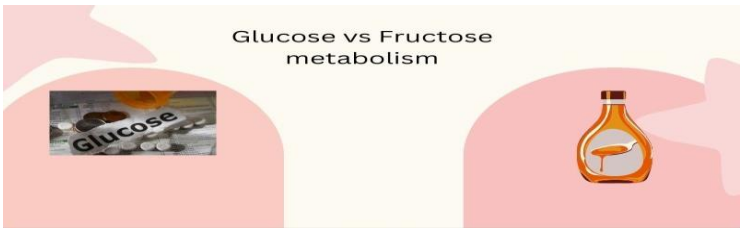
This led me to do some extensive "Google-searching" and I discovered several articles highlighting the association of sugar and especially fructose as a significant factor in increased uric acid levels. This revelation was enlightening and finally things were making sense, particularly considering the dietary habits in India, where fruit is often consumed in the form of juice or added to milkshakes and of course we have the popular ABC juice and various detox regimes which focus mostly on juices. Additionally, sugar substitutes such as jaggery, brown sugar, and palm sugar are widely regarded as healthy options. Honey, a staple in many Indian households, also contains high levels of fructose.

The current consumption of ultra-processed foods doesn't help the cause, so I went to the grocery store and looked up the various nutritional labels of the apparently healthy and not-so-healthy foods.

Examining the nutrition labels of various supposedly healthy snacks such as digestive biscuits, millet biscuits, Ragi biscuits Peanut Chikki etc. in grocery stores revealed the presence of sugar, sucrose, dextrose, liquid glucose, high fructose corn syrup, and other fructose-containing sweeteners. These ingredients are frequently listed second, indicating their high concentration. If this is how the healthy foods scored, I'd rather not talk about the "junk foods"!

I know it's been some years for most of us but let us revise some physiology and biochemistry.

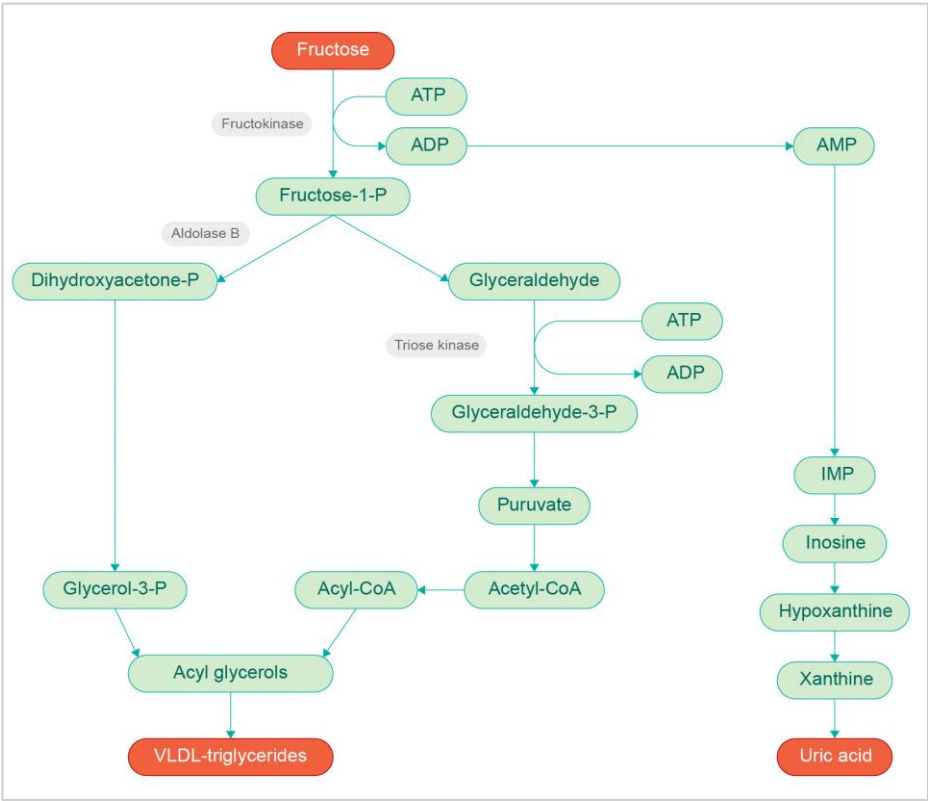
Table sugar is called sucrose and is composed of glucose and fructose. As far as the metabolic pathway is concerned glucose metabolism is tightly regulated, but unfortunately for us, fructose metabolism doesn't have as many checks in place



Glycolysis	Primary Pathway	Fructolysis
Hexokinase or Glucokinase	Initial Enzyme	Fructokinase (also called Ketohexokinase)
Glucose-6-phosphate	Initial Product	Fructose-1-phosphate
Phosphoglucose isomerase (converts G6P to F6P)	Second Enzyme	Aldolase B (cleaves fructose-1-phosphate)
Fructose-6-phosphate, Fructose-1,6-bisphosphate, Glyceraldehyde-3-phosphate	Key Intermediates	Dihydroxyacetone phosphate, Glyceraldehyde
Pyruvate	Final Product	Glyceraldehyde-3-phosphate, Dihydroxyacetone phosphate, Uric acid
2 ATP (net gain per molecule of glucose)	ATP Yield	Variable, often less efficient than glucose metabolism
Tightly regulated by insulin and feedback mechanisms	Regulation	Largely unregulated by insulin and bypasses key regulatory steps
Enters Krebs cycle for further energy production, stored as glycogen	Metabolic Fate	Primarily converted to fatty acids in the liver (lipogenesis)
Muscle, liver, and most tissues	Primary Organs	Primarily liver
Regulated blood sugar levels, risk of diabetes if dysregulated	Health Implications	Increased triglycerides, hyperuricemia, associated with fatty liver disease, insulin resistance, obesity, gout, and hypertension

Fructose is a monosaccharide found in sucrose (composed of 50% glucose and 50% fructose), and it is also found in fruits, honey, and various processed forms such high fructose corn syrup. It is primarily metabolized in the liver. More than 80% of fructose undergoes first-pass extraction in the liver. Here's a brief overview of the metabolic process:

i)Fructose is converted to fructose-1-phosphate by fructokinase C; ii)Fructose-1-phosphate is then acted on by Aldolase B, forming dihydroxyacetone phosphate (DHAP); iii) Glyceraldehyde-3-phosphate is acted on by thiokinase; iv) Fructose metabolism bypasses key regulatory steps in glycolysis due to highly active liver enzyme fructokinase C, resulting in rapid and unregulated phosphorylation of fructose; v) This process requires ATP, leading to ATP depletion and production of ADP and AMP; vi) AMP is converted to uric acid through a series of steps: AMP Adenosine-Inosine-Hypoxanthine-Xanthine-Uric Acid; vii) Uric acid then activates fructokinase C, perpetuating the cycle.



https://commons.wikimedia.org/wiki/File:Fructose_Metabolism.jpg

What is also important to understand is that fructose absorption differs from glucose absorption. Fructose is mainly absorbed through the intestines via facilitated diffusion via GLUT5 receptors and glucose is absorbed via active transport via SGLT1 and GLUT2 and GLUT4.

And because the absorption of fructose is different it means that when we consume fructose in a processed form such as in juices or ultra-processed foods there isn't any fibre which helps in slowing down the absorption of fructose.

Refined sugar and processed forms of sugar in sugar-sweetened beverages and ultra-processed foods is crucial in addressing hyperuricemia.

As Indians, we do have an inherent increased risk of visceral adiposity, hyperuricemia etc. Therefore in our population it is very important that we identify these dietary sources, so that we can more effectively counsel our patients on necessary lifestyle modifications to manage and prevent elevated uric acid levels and gout. It is also important to note that both fructose and uric acid stimulate lipogenesis, leading to insulin resistance and metabolic syndrome. Understanding this connection is extremely important, as we are seeing an increase in metabolic syndrome and insulin resistance, which are the main drivers of inflammation and non-communicable diseases.

It is crucial to emphasize that consuming fruit as fruit and not as juice/or in ultra-processed foods does not pose a health risk.

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Contributed by: Dr Nrutya Subramanyam

Making Healthy Choices Stick: Harnessing the Psychology of Habit Formation.

Dr. Shruthi Thennati

"All our life, so far as it has definite form, is but a mass of habits."
William James in "The Principles of Psychology"

In the intricate tapestry of human behaviour, habits form the threads that weave together our daily lives. These automatic behaviors, which often occur without conscious thought, shape everything from our morning routines to overall health and well-being. Understanding and harnessing the psychology of habit formation can empower individuals to make lasting, healthy changes in their lives.

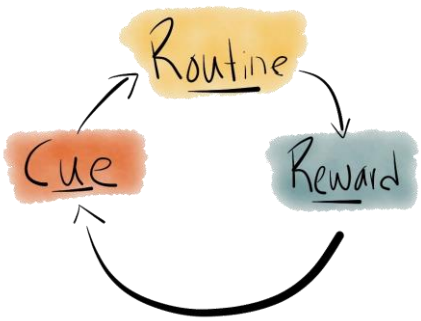
Habits are often viewed as hardwired behaviors that are difficult to change. People frequently believe that breaking a bad habit or forming a new, healthy one requires sheer willpower and discipline. There's a common notion that it takes exactly 21 days to form a new habit, a figure popularized by Dr. Maxwell Maltz in his book *Psycho-Cybernetics*. However, modern research indicates that this timeline can vary significantly depending on the complexity of the behavior and individual differences.

What is a Habit?

The modern concept of habit was first clearly laid out by the psychologist William James in the late 19th century1. He described habit as a routine, behavior, or even cognitive process that starts spontaneously but is repeated automatically as a result of prior experience.

A habit is formed through a process of reinforcement and becomes an automatic response to specific cues.

*The **habit loop**, a concept discovered by researchers at MIT2 and as mentioned by Charles Duhigg in his book "The Power of Habit", consists of three components:*
*1.**Cue**: A trigger that initiates the behavior.*
*2.**Routine**: The behavior itself.*
*3.**Reward**: The benefit gained from the behavior, which reinforces the habit loop.*



Examples of a habit loop:

Developing a habit of morning exercise:

Cue: Waking up in the morning to an alarm at a specific time everyday.
Routine: Performing a 10-minute workout.
Reward: Enjoying a refreshing smoothie or feeling a sense of accomplishment.

Forming a Habit of Regular Hydration:

Cue: Hearing a reminder alarm on your phone every hour.
Routine: Drinking a glass of water.
Reward: Feeling refreshed and maintaining adequate hydration for the day.

Physiology of habit formation

Understanding how habits are represented in the brain requires distinguishing habitual and goal-directed strategies in laboratory settings.

Habitual habits are behaviors that are performed automatically without conscious thought or consideration of the outcome. They are driven by repeated practice and reinforcement, becoming automatic responses to specific cues[3] .

Eg: The ritual of having coffee first thing in the morning can become a deeply ingrained habit, often performed without thinking.

Goal directed habits are behaviors that are performed with a conscious consideration of their consequences. These actions are based on a deliberate evaluation of the outcome and are adjusted according to the current value or desirability of the goal. Eg - A man choosing to eat a healthy meal because he consciously values its benefits for his health, and adjusts his eating habits based on his health goals[3].

Dickinson et al.[4] pioneered distinguishing these behaviours by establishing experimental paradigms that manipulate the relationship between a trained behaviour and its outcome. The initial paradigm, known as *reward devaluation*, involves decreasing the value of the reward that follows a behaviour. For instance, if a rat has been trained to press a lever to receive a reward, it is considered to exhibit a habitual response if it continues to press the lever at the same frequency, even when the reward has been altered to be unpleasant.

The second paradigm, known as *contingency degradation*, involves breaking the established link between an action and its rewarded outcome. For example, if a rat continues to press a lever at the same rate despite the reward being given randomly and without any connection to the lever press, it is displaying a habitual response. Since then researchers have developed several other paradigms to understand the difference between habitual and goal directed habits.

Neuroscientific research, using techniques ranging from lesion studies to functional imaging, reveals that habitual and goal-directed behaviors are represented by separate but interacting systems in the brain. These behaviors involve distinct pathways connecting the cortex and striatum of the basal ganglia: ***the cortico-striatal associative loop for goal-directed behavior*** *(linking the prefrontal and orbitofrontal cortices with the dorsomedial striatum) and* ***the cortico-striatal sensorimotor loop for habitual behavior*** *(connecting the sensorimotor cortex with the dorsolateral striatum).* ***As behaviors become more automatic, the sensorimotor loop increasingly encodes them, and lessening components of the goal-directed loop can drive an animal towards habitual behavior, highlighting the distinct yet interconnected nature of these systems.***

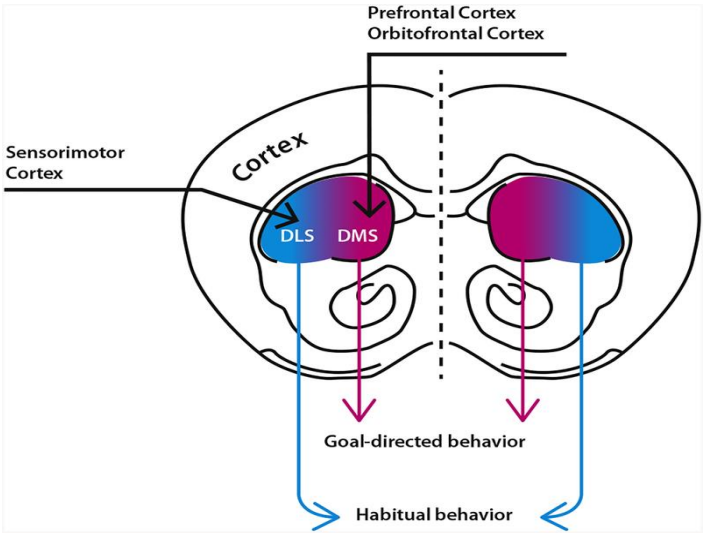


Figure - Corticostriatal circuits that contribute to habitual and goal-directed behavior :
DLS - Dorsal lateral striatum ; DMS- Dorsal Medial striatum
(Ref: Mendelsohn AI. Creatures of Habit: The Neuroscience of Habit and Purposeful Behavior. Biol Psychiatry. 2019 Jun 1;85(11):e49-e5

Forming a New Habit

Creating a new habit involves understanding and leveraging the habit loop. Here's a detailed step-by-step guide to help you form a new, healthy habit:

1. Identify the Cue

The first step in forming a new habit is to identify the cue, or trigger, that will initiate the behavior. A cue can be a specific time of day, an emotional state, or an activity. This element is crucial because it sets the stage for the habit loop to begin. For instance, if your goal is to start exercising, your cue might be something consistent like waking up in the morning at a particular time or having a specific alarm for a run. For emotional cues, feelings of stress or boredom might trigger a desire to snack or engage in physical activity. By clearly identifying and acknowledging this cue, you lay the groundwork for your new habit.

2. Define the Routine

Next, you need to define the routine, the specific behavior you want to turn into a habit. *To create an effective routine that can easily become a habit, it's beneficial to use the **SMART** criteria, ensuring your routine is Specific, Measurable, Achievable, Relevant, and Time-bound.* For example, instead of vaguely stating, "I want to exercise more," you could specify, "I will do a 10-minute workout every morning at 7 am for the next 3 months." *Breaking down the desired behavior into a clear, actionable routine makes it easier to start and significantly enhances the likelihood of successfully forming a new, healthy habit.*

Over time, as this routine becomes more engrained, you can gradually increase the intensity or duration to further embed the habit into your daily life.

3. Establish the Reward

Choosing an appropriate reward is *a vital step in reinforcing the new behavior*. The reward should be something that provides immediate positive reinforcement, making you feel good about completing the routine. For instance, after your 10-minute workout, you might treat yourself to a refreshing smoothie or a few minutes of relaxation. Alternatively, you could opt for longer-term rewards, such as tracking your progress and celebrating milestones, which help to maintain motivation over time.

The key is to find a reward that is meaningful and satisfying, helping to solidify the habit loop in your brain by associating the routine with positive outcomes.

4. Consistency is Key

Repetition is crucial for habit formation. Engaging in your new routine consistently helps to reinforce the behavior until it becomes automatic. Research by Dr. Phillippa Lally and her team at University College London suggests that it takes an average of 66 days to form a new habit, although this duration can vary depending on the complexity of the habit and the individual5. During this period, it's important to stick to your routine as consistently as possible. *Regular practice reinforces the neural pathways associated with the habit, gradually making the behavior a natural part of your daily routine.*

5. Be Patient and Flexible

Habits take time to form, and setbacks are a natural part of the process. It's important to be patient with yourself and to understand that occasional lapses are normal. Flexibility is also key; if you find that a particular routine isn't working well, be open to adjusting your approach. For example, if you discover that a morning workout doesn't fit well with your schedule, try exercising in the evening instead. Recognizing that habit formation is a journey rather than a destination allows you to navigate obstacles and continue progressing toward your goal. *Celebrate your successes, learn from your setbacks, and keep moving forward with your habit-forming journey.*

By following these steps and understanding the underlying principles of habit formation, you can effectively establish new, healthy behaviors that enhance your overall well-being.

"Creating" a Craving: The Key to Solidifying New Habits

Forming a new habit is significantly enhanced by creating a craving, a psychological drive that motivates the behavior. This concept is rooted in the brain's reward system, where cravings trigger the release of dopamine, reinforcing the desired behavior. Research by neuroscientists, such as the studies highlighted in *The Power of Habit by Charles Duhigg*, like the *The Claude Hopkins Pepsodent Study6* demonstrates that cravings are essential for habit formation.

For instance, individuals aiming to increase their water intake might develop a craving by associating the act of drinking water with the positive sensation of hydration. This can be facilitated by using a visually appealing water bottle and experiencing the refreshing effect of water, which triggers a dopamine release, making the behavior more rewarding

Similarly, those seeking to establish a morning running routine can focus on the endorphin rush and sense of accomplishment post-run. A study published in *Neuron* titled "Human Striatal Response to Monetary Reward Depends on Saliency" by Zink CF et al.[7] explains how the anticipation of these positive outcomes activates the brain's reward centers, promoting the repetition of the behavior.

By cultivating these cravings, individuals create a powerful internal drive that transforms the new behavior from a mere task into an anticipated and rewarding activity, thereby embedding it more deeply into their daily routine.

Overcoming Obstacles

1.*Environment Design:* Shape your environment to support your new habit. Remove obstacles that might hinder your progress and add elements that facilitate the behavior. For instance, if you want to eat healthier, keep nutritious snacks within reach and eliminate junk food from your home.

2.*Social Support:* Surround yourself with supportive people who encourage your new habit. Share your goals with friends or join a group with similar aspirations. Social accountability can be a powerful motivator.

3.*Self-Monitoring:* Track your progress to stay motivated and identify patterns. Use a journal, app, or calendar to record your successes and setbacks. Reflecting on your progress can provide valuable insights and reinforce your commitment.

Conclusion

Harnessing the psychology of habit formation allows individuals to make healthier choices that stick. By understanding the ***habit loop****,* ***identifying cues, defining routines, establishing rewards, and maintaining consistency,*** *anyone can cultivate new, beneficial habits. While the journey may be challenging, the rewards of improved health and well-being are well worth the effort. As William James eloquently stated,* ***our lives are but a mass of habits****. By intentionally shaping these habits, we can create a healthier, more fulfilling existence.*

Contributed by: Dr. Shruthi Thennati

Book Review
Book title: Why we sleep
Book author: Mathew Walker

Contributed by: Dr. Bhavani V

"If sleep does not serve an absolutely vital function , then it is the biggest mistake the evolutionary process has ever made.

Dr. Allan Retchschaffen

Can a book be fascinating and terrifying read at the same time? Mathew Walker's "Why we sleep" is. Fascinating to know the what's and why's of a basic physiological function that works wonders for us and terrifying to see how shamelessly we glorify not meeting this basic need of life and burn the candles at both the ends.

The narrative arc of this book is in four parts, which can be read in the logical order presented or each part can be read as a standalone essay without losing much. For a book that discusses an elusive topic like Sleep, the narrative flows easily, & much of the scientific information is presented in a clear and convincing language. The evidence presented is well referenced which gives a credibility to the read

The first part of the book answers the basic question of what sleep is. Mathew Walker explains with an eloquence the sleep rhythm , biological clock , neurobiological synchrony of initiating and maintaining sleep and the sleep cycle. I wish I had read this book in the first year of medical college- in my experience, none of the physiology book explains sleep better.

The second part of the book tries to answer questions of why we sleep, what happens when we sleep and also what if we don't sleep enough. The third part briefly talks about the ever enigmatic phenomenon of dreaming.

The final part is a discussion on various disorders of sleep, the epidemic of chronic sleep deprivation, how society as a whole is causing this sleep deprivation, the dis-ease it causes to individuals and institutions alike, the ugly truth of sleeping pills and what might actually help us to sleep better.

The book concludes on a positive note with the "*Twelve tips for a healthy sleep*"

This book is a storehouse of interesting information and presents a ton of facts that demand introspection. I have curated below some (like a trailer) that caught my attention.

"Scientists have discovered a revolutionary new treatment that makes you live longer. It enhances your memory, makes you more attractive. It keeps you slim and lowers food cravings. It protects you from cancer and dementia. It wards off colds and flu. It lowers your risk of heart attacks and stroke, not to mention diabetes. You'll even feel happier, less depressed, and less anxious. Are you interested?"

Book review: Why we sleep

It is quite fascinating to read about the evolution of sleep. Sleep , despite an universal feature across the animal kingdom , there is a remarkable diversity in the amount, form and pattern of sleep. When the ginormous elephants need only 4 hours of sleep , the petite brown bats require a whooping 19 hours of sleep! Dolphins, whales and birds can doze off with half a brain at a time, so the other half of the brain stays active and help in survival. How cool is the process of evolution!

The author puts forth an interesting evolutionary context to the chronotype variability observed in humans- morning larks and night owls. The reiteration that this variability is not a conscious choice but a genetic fate, can't be missed.

It is saddening to see the society and the current cultural sleep norms labelling the night owls as lazy and forcing them in a way to fit into a sleep-wake cycle that is rather unnatural for them. Owls are the most chronically sleep deprived, having forced to wake up with the larks but not being able to fall asleep until late at night. Quoting the author here : " Owls are thus often forced to burn the proverbial candle at both ends . Greater ill health caused by a lack of sleep therefore befalls the owls ."

The sociocultural sleep norms also fail to take into account the different circadian rhythms in young children, adolescents and adults. The fact that during puberty, the circadian rhythm undergoes a shift is discounted. Children, globally, are made to attend school at a time when they should in bed and dreaming. When REM sleep is what stands between rationality and insanity, robbing the teens of their REM sleep hours, needless to say, is deleterious.

The author brings about convincing evidence that prescription medications for inducing and maintaining sleep, may be effective in a short time but in the long run may not be beneficial. The ugly face of the adverse effects of such drugs makes us think twice. The argument that "existing evidence warrants more transparent medical education of any patient who is considering taking sleeping pills" to make an informed choice appreciating all the risks , couldn't be overlooked. All is not so gloomy! The non pharmacological treatment modalities including CBT-I and good sleep practices are the tools that could help us to secure a far better night of sleep.

The book provides a solid overview of why we have to wake up from the self imposed sleep deprivation and focus on getting a good restorative sleep everyday , throughout our lives. Sleep is one of the basic foundations of life and a building can only be as strong as the foundation .

You will not think about sleep the same , after you read this thought provoking book . Happy reading !

Contributed by: Dr. Bhavani V

Recipe Corner:
Plant based Dahi Bhalle

Dr. Smriti Naswa

Dahi bhalle are an integral part of any festive occasion in North India. They are relished by all age groups. I tell my patients to never cheat and always celebrate by switching to healthier ingredients. In this recipe section, I describe how one can make delicious dahi-bhalle without worrying about frying or other things. The recipe was created by my mother-in-law, who is more a chef than a home-maker, and kitchen is truly her laboratory.

Ingredients for vada/Bhalla- makes 24 vadas
1Yellow split gram (Moong dhuli dal) - 1 cup
2.Split black lentil (Urad dhuli dal) - 1/2 cup
3.Himalaya Salt to taste

Ingredients for peanut curd- makes 1 litre peanut curd
1.Raw peanuts- 1 cup
2.Curd starters (any option of the following can be used)
a)2-3 tsp of non-dairy yoghurt
b)Yoghurt starter culture or probiotic capsule (follow instructions as per pack)
c)8-10 green chilli tops/crowns

Other Ingredients
1.Mint leaves
2.Green chilli - 1-2
3.Tamarind chutney
4.Coriander mint chutney
5.Salt
6.Roasted cumin powder
7.Red chilli powder (optional)

Method for preparing vadas/bhallas:

Making the batter: Mix both dals & soak for 5 - 6 hours. Drain the water. Grind with little water & make a smooth paste. Add salt to taste. Mix the batter with light hand. Take a glass of water & put little batter in the glass; if it floats, the batter is ready.

Making vadas-Take Appam kadhai & brush with oil. Take little batter & put in the Appam kadhai moulds. Cover for 5-6 minutes. Once, one side is cooked, flip the vadas upside down and again cover with the lid. After 4-5 minutes, take out all the vadas. Repeat the process for second lot. Put the vadas in cold water. You can keep the vadas in fridge for 1-2 days. Whenever you wish to consume, take out from the fridge, soak in warm water for 2-3 mins. Then squeeze the vadas to remove excess water and vadas are ready to eat.

Method for preparing peanut curd:

Peanut milk:Take 1 cup of raw peanuts, soak for 7-8 hrs. Grind with little water. Take a muslin cloth, keep it on a bowl, pour the mixture, squeeze with light hands. Mix again with water & squeeze. One kg milk is prepared with 1 cup peanuts.

Recipe Corner:
Plant based Dahi Bhalle

Dr. Smriti Naswa

Making peanut curd:

Put the peanut milk in a pan, place on the stove and switch on the gas keeping it on medium flame. Keep stirring and bring it to 3-4 boils. Take 50 ml water and mix 3 tea spoon of rice flour and mix it in the boiling milk; keep stirring for 2-3 boils. After this, switch off the gas. Keep this milk covered and let it cool. When the milk temperature is lukewarm, add 3 tea spoon of peanut curd/ 8-10 green chilli tops. Mix and keep for 10- 12 hours to set (it takes more time than dairy yoghurt).

Preparing Dahi Bhalla:

Keep the peanut curd in the fridge for 3-4 hours. Squeeze the vadas and keep in a bowl/ a plate. Take peanut curd, put in a mixer/ grinder and add few mint leaves and one green chilli, add some ice and grind in the mixer. Pour this mixture on the vadas, add roasted cumin powder, tamarind chutney, coriander-mint chutney and salt and red chilli (optional) to taste.

Serve fresh and enjoy guilt-free.

Contributed by: Dr. Smriti Naswa